United States Department of the Interior

FISH AND WILDLIFE SERVICE
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Memorandum

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To: Assistant Regional Director, Region 5, Hadley, Massachusetts

From: Supervisor, Virginia Field Office, Gloucester, Virginia Susan Lingenfelser Acting Supervisor

Subject: Biological Opinion, Warren County Power Station Low Effect Habitat Conservation Plan

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed issuance of a section 10(a)(1)(A) incidental take permit (ITP) in conjunction with the Warren County Power Station low effect habitat conservation plan (HCP) and its effects on the federally listed threatened Madison Cave isopod (*Antrolana lira*) (MCI) in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). Formal consultation was initiated on August 19, 2011 at the request of the Service's Northeast Region Endangered Species Program.

This biological opinion is based on information provided in intra-office memoranda, project plans and drawings, meetings, electronic mail, and other sources of information. A complete administrative record of this consultation is on file in the Virginia Field Office (VAFO), Gloucester, Virginia.

CONSULTATION HISTORY

04-26-11	The Service received a phone call from Dominion Virginia Power (DVP) indicating their intent to apply for an ITP.
04-29-11	The Service participated in a conference call with DVP, Virginia Department of Game and Inland Fisheries (VDGIF), and Virginia Department of Conservation and Recreation - Natural Heritage Program (DCR-NHP) to begin developing the HCP.
05-05-11	The Service participated in a conference call with DVP, VDGIF, and DCR-NHP to continue coordinating the HCP.
05-13-11	The Service met with DVP, VDGIF, and DCR-NHP (via conference call) to review a draft HCP and ITP prior to submission.
05-27-11	VAFO briefed Service Regional Office (RO) personnel on the HCP.
05-27-11	The Service provided comments on the draft HCP to DVP.

05-31-11	VAFO personnel participated in a conference call with RO personnel, VDGIF, and DVP to review draft HCP comments.
06-15-11	VAFO participated in a conference call with DVP, RO, and the Department of Interior Regional Solicitor's office, to review the draft HCP.
07-15-11	The Service received a check from DVP for the ITP application, completing the application.
07-19-11	The Service received a draft of the monitoring plan from DCR-NHP.
07-26-11	VAFO sent the surname package to the RO for signature.
08-04-11	The RO reviewed and signed the surname packet and sent it to the Regional Director.
08-22-11	The Service published a Federal Register notice announcing the receipt of a HCP and application for an ITP.
09-20-11	VAFO received a letter of support for the project from DVP during the comment period for the HCP and ITP application.
11-18-11	The Service received the final HCP which incorporated minor revisions, and the final Implementation Agreement from DVP.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The proposed action is the issuance of an ITP for incidental take of MCI in conjunction with a low effect HCP. DVP proposes to construct and operate a natural-gas fired electrical generation facility capable of generating a nominal electrical output of up to 1,500 megawatts on a 39 acre parcel in Warren County, Virginia. The proposed facility will include the installation of three advanced firing natural gas turbines in combined-cycle mode, each provided with a Heat Recovery Steam Generator and one steam turbine generator. The fuel for the combustion turbines will be natural gas provided to the site by a new pipeline, approximately 2 miles long, that will connect to an existing pipeline. Water for the steam generators will be provided by the Town of Front Royal via pre-existing pipelines. The site is in an industrial park and has previously been disturbed. Initial site preparation will include grading, tree removal, and reverse grading of the mantled sinkholes. Reverse grading will follow DCR-NHP guidance (Figure 1).

Currently two stormwater dry detention ponds exist on the site but do not provide adequate sediment or contaminant removal before water is directed to an off-site sinkhole where it enters into the aquifer. They allow turbid water to enter the aquifer and remove approximately 20% of the phosphorus prior to entering the aquifer. The proposed power station includes three storm water ponds. The existing ponds will be enlarged, retrofitted, and become Ponds #1 and #2. Ponds #1 and #3 are connected in series; Pond #3 will be placed to capture the runoff that has the highest probability of containing hydrocarbons. The third pond, Pond #2, will capture runoff from the remainder of the site. Ponds #1 and #3 are designed to hold and treat a 100-year storm event and Pond #2 is designed to hold and treat a 10-year storm event with an emergency spillway. Both drain into the county drainage system. Pond #1 is designed to reach 65% phosphorus removal and Pond #2 is designed to reach 40% phosphorus removal. All of the detention ponds will be lined with impermeable clay liners, will contain a standpipe with a manual shut-off valve that can be closed if necessary, and will be fitted with shut-off valves and hydrocarbon detectors with a detection level of 10 milligrams/liter (mg/l). Stormwater from the parking areas and containment structures will be routed through oil/water separators prior to discharge into the ponds.

Approximately 17 power station structures will be supported by a foundation supported by the underlying karst rock (Figure 2). DVP proposes to install up to 2,234 micropiles in combination with driven H-piles to support heavier or critical structures where susceptibility to sinkholes is not tolerable, and tolerance to total or differential settlement is minimal. Micropiles will be driven through voids in the rock stratum until they reach a minimum depth of 10 feet (ft) within competent rock. Micropiles are installed using a two step process: 1) a pilot hole less than 2 inches in diameter is drilled to determine the appropriate depth 2) an air drill enclosed in a steel casing is drilled to the pre-determined depth. As the drill advances the casing follows and ensures the drill hole is separated from the surrounding environment. The air within the casing is pressurized and acts as a conduit to transfer the drill cuttings to the surface. If the air drill intersects a void there is a limited period of time between when the void is intersected and when the casing is slipped down to the surface of the rock, in which the cuttings may enter the karst system. After reaching the pre-determined depth, the drill head is withdrawn and the casing is left in place, an inner steel pipe is inserted through the casing, and the casing is then filled with concrete. The micropiles will be no more than 7 inches in diameter. DVP estimates at most 2,234 micropiles will be installed at the site at either 6 ft or 8 ft spacing. If an H-pile is used, it will be driven into the rock either by pounding or vibration until it no longer advances. H-piles are typically installed where the bedrock is shallow. The depth of the H-piles will depend on the strength of the rock and the force applied. They are "H" shaped in cross section and range from 10-18 inches square and the metal ranges from 0.435–0.685 inches thick.

Approximately 13 caissons (which are not expected to penetrate MCI habitat) will be installed in the upper layers of earth and rock to support a series of transmission line towers across the site. They will not be placed in areas of known sinkholes. Their installation will require drilling a pilot hole, then insertion of a steel casing, which will be filled with concrete. The largest potential diameter is estimated to be 8 ft. To be conservative, DVP is including the caissons in their calculation of potential habitat impacted though it is unlikely that the caissons will penetrate into karst rock that may support MCI.

An estimate of cross-sectional area that would be occupied by micropiles and H-piles was calculated using the number of borings within the proposed foundation, their diameter, and a buffer to account for spalling and sedimentation around the micropiles. Approximately 2,234 ft^2 will be occupied by the micropiles or driven H-piles (expected to penetrate MCI habitat). The same method was used to determine the area occupied by caissons; approximately 663 ft^2 of subterranean habitat would be occupied by the caissons (not expected to penetrate MCI habitat). In total, this project will encroach upon an estimated total of 2,897 ft^2 (0.07 acres) of subsurface habitat.

DVP will mitigate for impacts by establishing a Deed of Open Space Designation on a 18.41 acre parcel owned by Warren County, Virginia. The mitigation lands will be covered lands within the HCP. The parcel is comprised of a 7.67 acre swale that includes Brother Dave's Cave, a known MCI site, and 10.74 acres of forested buffer east of the swale. The mitigation site is in Warren County, approximately 0.2 miles from the project site. DVP is currently working with the County and the Service on terms of the Designation. In addition to the Designation, DVP will fund water quality and MCI population monitoring at Brother Dave's Cave prior to construction and for eight years after construction. Water quality monitoring will measure temperature, turbidity, conductivity, and water levels at Brother Dave's Cave and Power Plant Pit, nearby sites, and a reference site. Population monitoring will entail mark-recapture work to try to assess population trends. DVP will submit annual reports to the Service.

Action Area - The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project is the 39 acre project site and the 18.41 acre mitigation lands. The noise and vibrations that exceed background levels are expected to occur within this area.

STATUS OF THE SPECIES

Species Description and Life History - The MCI was listed as a threatened species on October 4, 1982 (47 FR 43699). No critical habitat has been designated for this species. The listing was based on a number of factors including, but not limited to: its known range, vandalism, siltation events, and potential mercury contamination. Current threats include: thermal and chemical pollution from urban development and agricultural runoff (e.g., poultry farming), physical pollution, and human disturbance (cave vandalism and visitation). Obstacles to recovery include a lack of ecological and life history information for MCI and a lack of information regarding the physical limits of recharge zones that affect MCI habitat (Service 1996).

The MCI is a stygobite, a freshwater subterranean aquatic crustacean, first described by T. E. Bowman in 1964. It belongs to the family Cirolanidae that consists of mostly marine species and a small number of freshwater species. It is the only member of the genus *Antrolana* and the only freshwater cirolanid isopod north of Texas. It is also the only known stygobitic cirolanid whose current habitat is completely isolated from the marine environment.

MCIs are predominantly adapted to unlighted deep karst aquifers and subsurface lakes where the water temperature ranges from 51.8 to 57.2°F and the water is supersaturated with calcium carbonates (Service 1996). In the karst geology, subsurface waters (both water contained in the bedrock and water contained in open spaces) are dynamic and may move quickly through voids in the bedrock. For this reason, bedrock is not likely to be an effective sediment filter for subsurface waters. Because the presence or absence of voids, fractures, and solution cavities within bedrock is unpredictable in karst geology, there may be instances where surface waters directly connect to subsurface waters.

MCIs have evolved into obligate stygobites, having lost their eyes and all traces of pigment in their exoskeleton. Their body is flattened and has seven pairs of long walking legs. The first pair of legs is adapted as grasping structures. They have a pair of short antennae and a pair of long antennae. Males reach a length of 0.6 inches; females reach a length of 0.7 inches. This species is a strong swimmer and a benthic walker. Because this species lives in a habitat that is difficult to study, relatively little is known about its reproduction, home range, trends in population, lifespan, life cycle, and ecological relationships. The limited knowledge of its feeding habits suggests it is an omnivore, likely acting both as a predator and scavenger. It is thought to feed on small pieces of plants and animals flushed in from surface opening (Service 1996).

Population Dynamics – The population size of the MCI is unknown at most sites. MCI can be difficult to capture at known locations other than Madison Cave and Steger's Fissure, so little information is available on abundance for most sites and no meaningful population trend data is available. To date, Madison Cave and the adjacent Steger's Fissure have consistently yielded numerous individuals when sampled. Population abundance has been calculated for those sites and Irvin King Well #2, West Virginia. Fong (2007) conducted a series of mark re-capture studies at the Madison Cave and Steger's Fissure sites. He sampled in 1995, 1997, 2004, and 2006. His work estimated the population in Madison Cave ranged from 360 to 1,020 individuals and from 2,240 to 3,420 individuals in Steger's Fissure. Between 1997 and 2006 there was little fluctuation. Four sites were sampled in Jefferson County, West Virginia where MCI was known to occur (Hutchins and Orndorff 2009). Marked animals were recaptured from only one site, Irvin King Well #2. Estimated abundance at this site was 112 ± 110 individuals. The large confidence intervals indicate a high degree of uncertainty in this population size estimate. They did not estimate population trends.

Status and Distribution - The MCI lives underground in the flooded ionically-saturated waters of deep karst aquifers of Cambro-Ordovician aged carbonate bedrock (limestone and dolostone). Orndorff and Hobson (2007) delineated MCI potential habitat based on the extent of carbonate bedrock in which MCI has been found. Their layer extends through 10 counties, from Rockbridge County, Virginia to Jefferson County, West Virginia (Figure 3) and represents approximately 865,028 surface acres. When the recovery plan was written the taxon was known initially from deep (phreatic) cave lakes and streams fed by deep cave lakes from seven sites and thought to be endemic to Virginia. Increased survey efforts have more than doubled its known range. Recently MCIs were discovered in wells that intersect phreatic or groundwater habitats, where there is no obvious nutrient source or visible indication that the area was inhabited by MCI. At these sites, it is likely the water is flowing from nutrient-rich to nutrient-poor areas.

Presence/absence sampling for this species has numerous uncertainties, which make data difficult to interpret. Sampling for MCI requires access to phreatic water, which fluctuates in depth depending on water table levels. Without knowing how large an area the baited traps are sampling, it is unclear how large an area the survey results at discrete sampling points represent. We expect hydrologic conditions such as water level and flow would affect the size of the sampling area. Repeat sampling at known locations does not indicate a change in the populations. Sites that have traditionally yielded a large number of MCI such as Steger's Fissure and Madison Cave continue to produce large numbers. Sites that have more moderate or low numbers continue to produce similar numbers. The known species range has increased; we assume this is due to increased survey efforts rather than a species expansion. Currently MCI have been recorded from 16 locations within the Shenandoah Valley from Leetown, West Virginia south to Lexington, Virginia: a range 136.4 miles long and 24.8 miles wide (Hutchins 2007).

Preliminary genetic work indicates three unique genetic populations (clades) exist in the Shenandoah Valley that diverged several million years ago. Fong and Hutchins (2006) determined the number of genetic units of MCI by studying the within- and between-site cytochrome oxidase *c* subunit I (COI) mitochondrial gene variation. They collected mitochondrial DNA samples from nine sites in four counties: Jefferson County, West Virginia, and Warren, Rockingham, and Augusta Counties, Virginia. They were unable to collect samples from some locations due to being denied access or sampling efforts that yielded no MCIs at known locations. Their results indicated three distinct lineages (haplotype groups) corresponding to three geographic areas, northern, western, and southern groups. They were unable to sample Front Royal Caverns and are uncertain whether it is part of the northern genetic unit. Front Royal Caverns may not be part of the northern genetic unit because it is on the opposite side of the Shenandoah River from the northern sampling sites. None of the groups shared any haplotypes and the data strongly indicated there are at least three genetic units. It is possible there are more than three genetic units, and additional genetic analysis may refine the understanding of management units. The most southern known location, Limekiln Cave, is geographically distinct and isolated from the others. The Maury River watershed (James River drainage) is the only known location outside the Shenandoah River drainage. The three lineages "exhibit 10-11% divergence in the COI gene suggesting isolation for at least three and as much as 21 million years." (Hutchins 2007). Hutchins also noted the three lineages exhibit comparable levels of genetic divergence, which indicates separate simultaneous colonization events rather than migration out from a single area. Although there were significant differences between the three geographic areas in this study, they were not different enough to warrant consideration as distinct species. However, Hutchins et al. (2010) recommends treating the three genetic units as management units until additional data are collect to determine if classification as Evolutionarily Significant Units is warranted. Additional distinct genetic units may be present from populations not yet sampled.

<u>Factors Affecting the Species</u> - MCI habitat is degraded by altering water flow patterns, which can lead to a reduction in available habitat if water is diverted or increases in sediment and contaminant loads if the system becomes flashy. Water flow patterns are altered by many factors including increased impervious surfaces, filling sinkholes, and shifting subsurface formations and hydrology. Flow patterns may change depending on the amount of impervious surfaces in the recharge zone. Impervious surfaces decrease the amount of land available for groundwater recharge and may increase the flashiness of the system by preventing rainwater from filtering back into the ground. In developed areas, instead of channeling water back to the aquifer, water may be directed to a central water treatment facility, in essence dewatering the MCI habitat. A drop in groundwater may prevent the MCI from accessing some of its travel corridors if the corridors can only be accessed when water levels are high. Impervious surfaces may also cause elevated sediment loads in the groundwater and clog sinkholes and interstitial spaces with sediment and debris. This prevents water from reaching the MCI and potentially blocks travel corridors. Increased impervious surfaces also results in reduced vegetation to provide nutrients

in the form of detrital material and less water directed back to the system carrying these nutrients underground.

Likely physical barriers have led to isolation of sections of some populations and contributed to creating new genetic units or clades. Activities such as blasting, chiseling, trenching, or digging may cause shifts in surface and sub-surface formations and hydrology. These typically occur in concert with land clearing for land development, constructing new roads, and sewage, water, or gas pipelines. Sudden shifts in subterranean structures created from these activities may crush or trap MCIs, cause excessive sedimentation and reduced habitat suitability, and alter their travel corridors and the hydrology.

Contamination of groundwater is an increasing threat, and the degree of contamination is largely unknown. MCI habitat is susceptible to groundwater contamination due to its porous nature and limited filtering abilities. In rural areas agricultural practices such as large scale biosolids and pesticide application are ongoing and may threaten the quality of the habitat. In 2006/2007 the U.S. Geological Survey (USGS) (Boughton 2007) sampled groundwater for contaminant levels from wells in potential MCI habitat in Jefferson and Berkeley Counties, West Virginia. Samples were analyzed for a broad spectrum of contaminants including pharmaceuticals and pesticides. USGS found the herbicide atrazine in low levels in four of the six sites. One site in Jefferson County contained detectable concentrations of atrazine, prometon (herbicide), tetrachloroethylene (dry cleaning or degreasing solvent), 1-4 dichlorobenzene (insecticide and deodorizer in some manufacturing processes), and bisphenol-A (widely used plasticizer). The levels of these chemicals were found below their Ambient Water Quality Criteria, developed by the Environmental Protection Agency for the protection of aquatic organisms. It is noteworthy that contaminants were detected because we do not know how they may affect the MCI, and it illustrates the susceptibility of the phreatic aquifer to contamination.

ENVIRONMENTAL BASELINE

Status of the Species/Critical Habitat Within the Action Area – Approximately 29,654 acres of potential MCI habitat are in Warren County; the action area represents approximately 1.8% of this habitat. The MCI potential habitat covers 865,028 surface acres in 10 counties. The northern genetic unit, which consists of Warren and Clarke Counties, Virginia, and Jefferson County, West Virginia, includes 223,432 acres of potential habitat (0.23% of potential MCI habitat).

The project site is 0.2 miles away from Brother Dave's Cave and Power Plant Pit. MCIs were initially found at these sites in 2002; a follow up survey occurred in 2006. Results from both surveys are included in the 2007 status survey by Orndorff and Hobson (2007). Table 1 is an excerpt from 2007 status survey and presents the findings for these two sites. These sites were qualitatively sampled so trends or species status cannot be determined other than their continued presence at the sites.

Table 1. Survey Results for Madison Cave isopod (Orndorff and Hobson 2007).

Survey Date	Site Name	Well or Cave	Habitat	County	# of MCI	Notes
02/27/02	Power Plant Pit	Cave	phreatic, static	Warren	5	Initial find at Power Plant Pit with Mike Horne
02/27/02	Brother Dave's Cave	Cave	phreatic, static	Warren	17	Initial find at Power Plant Pit with Mike Horne
01/12/06	Power Plant Pit	Cave	phreatic, static	Warren	several observed	
01/12/06	Brother Dave's Cave	Cave	phreatic, static	Warren	1 collected	*S. biggersi* and *S. gracilipes*

It is not possible to accurately determine the presence or abundance of MCI at the project site due to the lack of effective survey protocols, access to habitat, and knowledge of subsurface connectivity. We are assuming that the MCI is present at the project site based on the potential habitat model, which is based on the geologic layer in which MCI have been found, and the proximity to Brother Dave's Cave and Power Plant Pit, known MCI sites. We are uncertain whether the MCI captured at the nearby sites represent the number of MCI in the phreatic system below the project site, and how the number captured relates to the MCI population in the vicinity of these two sample sites because the extent of the area (i.e., amount of subterranean MCI habitat) connected directly to the trap sites is unknown. The trap may inflate the number of MCI captured because it is baited and will attract individuals, rather than passively sampling the isopod population in the water. These results might also under represent the number of MCI at the sampling location due to water levels or the ability to access the phreatic layer with the baited trap. Taking these factors into consideration, the best estimate of species abundance at the project site are the 2002 and 2006 survey results from Brother Dave's Cave and Power Plant Pit.

DVP modeled the density of MCI in the karst system below the project site and estimated the number of potentially affected individuals based on the modeled density. Modeling was based on the number of *Cirolanides texensis*, a closely related isopod, per square foot in an aquifer in Texas. The estimated density was 0.02 MCI/ft^2 which extrapolated to 33,977 MCIs beneath the karst system of the project site. This number is likely inaccurate because it does not incorporate any site- or species-specific information, but it provides a useful means to consider the potential impacts to MCI relative to the population that may occur in the area. The highest in situ estimates of MCI near the project site are "several observed" and 17 (Orndorff and Hobson 2007). Researchers have estimated MCI population size using mark re-capture techniques in three locations, Madison Cave (360-1,020 MCI) and Steger's Fissure (2,240-3,420 MCI), Virginia, and King Irving Well (112 ±110 MCI), West Virginia. The modeled density estimates are more than an order of magnitude lower than the model, further suggesting that the estimate of 33,977 MCI at the DVP project site is high. The modeled number of MCI on the site far exceeds the total number of MCI ever found at all sites where the species occurs, and likely significantly overestimates the number of MCI in the area.

Factors Affecting Species Environment Within the Action Area – The project site is zoned for industrial use and has already been degraded. It is located in an industrial park that includes several structures and facilities nearby. Basic infrastructure has been installed including roads, water and sewage lines, transmission lines, and stormwater management ponds. This site has been classified as potential MCI habitat in the potential habitat model. There are a series of stormwater collection ditches within the industrial park, and many of these discharge stormwater directly into sinkholes and other karst features, resulting in potential for contamination and altered groundwater infiltration rates.

The mitigation site is an 18.41 acre parcel of high quality MCI habitat. The mitigation site consists of a 7.67 acre swale and a 10.74 acre forested buffer. The opening to Brother Dave's Cave is contained in the swale, which is one of 16 discrete known MCI locations. The site is currently owned by Warren County and has not been developed.

EFFECTS OF THE ACTION

Direct and Indirect Effects – We expect several potential impacts to MCI from proposed issuance of a section 10(a)(1)(A) ITP in conjunction with the low effect HCP. While the construction techniques for this project are intended to avoid and minimize impacts to MCI, they involve drilling holes and installing micropiles in karst features that may serve as habitat for the species. If MCI do not move away from the site during active construction, we anticipate injury or death of MCI may result from impingement from the drill head, insertion of micropiles, or loose rock. However, the likelihood of the drill entering a void occupied by a MCI is small, and we expect the MCI will be able to avoid these effects in many cases. Because the MCI is a subterranean species their senses other than sight are likely heightened. We expect they would detect the vibration from the drilling before it reaches the immediate area where isopods occur and move away from the area. However, due to their presumed sensitivity to noise and vibrations, we expect disturbance of MCI in the vicinity of the construction, resulting in temporary to prolonged avoidance of the project site and interruptions in normal behaviors. The fractured nature of the geology in the area generally provides numerous travel corridors, which reduces the likelihood that micropiles would isolate MCI by blocking subterranean pathways and would allow MCI to avoid the on-coming drill.

H-piles are driven until first refusal, which will vary depending on the side friction and composition of the rock into which it is driven. We expect driving the H-piles will not penetrate as deep as the micropiles because they are typically installed where the bedrock is shallow. Their installation will produce vibrations and as with the installation of the micropiles, we expect the MCI will move away before the H-pile might intersect MCI habitat. H-pile installation will likely introduce a small amount of sediment. The odds of the H-piles intersecting a void are low because they are installed in shallow bedrock subsequently the likelihood an H-pile will block MCI travel corridors is low. Caisson installation may have similar impacts to MCI and their habitat as micropile installation. We expect the vibration will cause MCI to move from the project site. Once installed, the micropiles, H-piles, and caissons may occupy areas that were previously MCI habitat. Because the affected areas are discontinuous, MCI are expected to re-occupy the affected areas following construction.

Geo-technical reports (Schnabel 2007) state that groundwater levels at the site vary from approximately 7 to 44 ft below the surface. The water levels in Brother Dave's Cave and Power Plant Pit are consistently lower, approximately 33 ft below the surface. This likely indicates a perched water table, locally and seasonally present, on top of the limestone surface below portions of the project site (Orndorff 2011). Orndorff (2011) indicated the bedrock in the area is generally higher than the water table and the geology is layered from the surface downward as: epikarst, air-filled voids, and finally the saturated phreatic layer. The MCI inhabit phreatic water, which is lower than the upper extent of the rock, and MCI would not be expected in a perched aquifer unless stranded during times of high water when the two water tables connect. Because of the depth of the phreatic layer, intersecting it before encountering 10 ft of solid rock is unlikely, and some portion of the micropiles and H-piles are not expected to extend to the phreatic aquifer or affect MCI or their habitat.

We expect the amount of sedimentation entering the system during micropile installation to be minor. The use of micropiles and their steel casings will capture the majority of sediment generated during drilling and act as a conduit to carry the drill cuttings and potential sources of sedimentation to the surface. A situation most likely to introduce sedimentation into the system would be if the drill encounters a void. Some rock cuttings may enter the system during the initial operator response period prior to stopping drilling and slipping the casing down through the void. If an H-pile were used rather than a micropile we expect a minor amount of sediment will enter the system if it encountered a void. Because H-piles are driven into the substrate until refusal they likely will not go as deep as a micropile and therefore the odds of encountering a void would be less because they are going through less substrate. The sediment amounts generated from H-piles is expected to be less than for micropiles since the installation does not involve drilling which generates fine sediments. Sedimentation from caisson installation is expected to be greater than for micropiles because the diameter of the drilled hole is larger and because drilling is not contained within a casing, drill cuttings are more likely to enter the waters than the micro-piles. However, the likelihood that sedimentation will impact MCI habitat is smaller because the caisson placement will avoid sinkholes and other karst areas with surface indications of connections to phreatic water.

Sediments are expected to interfere with movement of MCI and temporarily interrupt normal activities including breeding, feeding, and sheltering. Sediment that settles within the cavities occupied by MCI may affect habitat suitability and food availability, leading to reduced habitat suitability and reduced feeding opportunities. The accumulated sediment is expected to dissipate over time, and habitat suitability will return within months to years following the completion of construction. Some of the sediment may, over time, be transported out of the project site by flows within the phreatic waters, and this sediment may result in minor reduction in habitat suitability. Because the amount of sediment that will be transported beyond the project site is low, and the concentration of suspended sediment is expected to be low, the potential effects of sedimentation beyond the project site are insignificant and discountable.

Runoff from the site will be directed to stormwater management ponds prior to entering the phreatic system. For this reason we do not expect a significant loss in water recharge to the system. Despite the improved treatment capacity of the proposed stormwater ponds compared to the existing ponds, minor sedimentation and contamination may result from stormwater management. Sediment entering the system may interfere with MCI respiration and feeding. MCI are expected to move out of the affected areas and return once the water has cleared. We expect this would be a temporary impact.

Changes in vegetative cover at the project site may reduce MCI habitat suitability through loss of nutrients entering the phreatic system. To estimate the benefit of conserving the mitigation site, DVP developed a model to quantify changes in nutrients available to the phreatic system in terms of net primary productivity (NPP). NPP measures the rate that plants convert carbon dioxide into organic compounds via photosynthesis. The model estimated vegetative cover prior to construction activities and cover after construction will be completed and assigned NPP values based on the vegetation cover at the project site. Their model was based on net values from Huston and Wolverton (2009). Values used were 779 grams/meter^2/year NPP for mature forest, 393 g/m^2/year NPP for grass and shrub dominated areas, and 586 g/m^2/year NPP for partially forested areas that are a mix of grass and trees. DVP used these values per acre of surface cover type affected. The model estimates a loss of 13,792 g/m^2/acre/year NPP will occur from the construction of the project. We expect the loss of NPP would have minor affects on the amount of organic material, via small pieces of plants, available for consumption by the MCI. Currently plant material available for consumption by the MCI is not being provided from the site because open throated karst features, which would provide a direct conduit for the material, do not exist at the project site.

<u>Beneficial Effects</u> – During construction the stormwater management ponds will be upgraded. After the upgrades, phosphorous removal from the stormwater ponds is expected to increase from 20% to 56% and contaminants entering the phreatic system will be reduced. If the hydrocarbon detectors in the stormwater ponds indicate concentrations of 10 mg/l or higher, the manual shut off valve in the detention pond will be closed to prevent discharge of hydrocarbons. Little is known about the effects of contaminants, including hydrocarbons, on MCI, but levels exceeding 10 mg/l may result in negative effects to a variety of aquatic organisms (Buchman 2008). DVP's response to a hydrocarbon alarm will vary according to what is found, but in most cases a permitted waste contractor with a pump truck will remove the contaminated water to dispose of it according to regulations. If there is sheen on the water, absorbent pads would be set out, but sheen is unlikely if the oil/water separators are working properly. The oil/water separators will also be cleaned if they have a sediment buildup or floating debris or oil. Prior to these upgrades, hydrocarbon that entered the stormwater ponds entered the phreatic system.

The nutrient model estimates 12,151 g/m^2/acre/year NPP will be preserved through the mitigation site. There is a deficit of 419 g/m^2/acre/year NPP between the NPP lost through construction and the NPP preserved through mitigation. This imbalance represents slightly more than 1 acre if calculated using the NPP value for cover type grass/disturbed, which is the lowest model value. While there is an imbalance, modeling NPP estimates mitigative trade-off of the site's functions in terms of plant biomass where as the impact is to the MCI and its habitat, which is not directly related to biomass at a site. The protection of the mitigation site and its cave, swales, and surrounding forested buffer will ensure continued high quality MCI habitat. The project site is comparatively degraded because it is located in an industrial park with stormwater management ponds that continue to threaten the quality of the MCI habitat, as well as little vegetation and limited buffers around sinkholes. The loss of NPP between the project site and the mitigation site is offset by the quality of the mitigation site and the upgraded stormwater management system. Therefore, the approximately 18.41 acres of habitat protection provided is considered to be appropriate and adequate compensation for impacts to MCI habitat.

Interrelated and Interdependent Actions – An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The Warren County Power Station will be fueled by natural gas delivered to the site by a gas pipeline that will be installed to connect the facility to a nearby natural gas distribution pipeline. The approximately 2 mile long proposed pipeline will be regulated by the Federal Energy Regulatory Commission (FERC), and section 7 consultation on the pipeline installation and operation will be conducted with FERC following evaluation of alternative pipeline routes. This pipeline has potential to affect MCI, and the effects will be considered in a subsequent consultation. Power will be distributed through an existing powerline, and no additional interrelated actions have been identified related to power distribution. The power station is expected to operate for up to 50 years following completion of construction. Because the power station almost exclusively utilizes an existing water supply, wastewater treatment systems, and power distribution, no adverse effects to MCI or its habitat are expected beyond the initial construction.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. No cumulative effects have been identified.

CONCLUSION

The magnitude and severity of all effects to the MCI are anticipated to be minor since the majority of the impacts are short-term and temporary, and the footprint of the project represents a small fraction of potential MCI habitat. The project is anticipated to affect less than 1% of the potential MCI habitat rangewide. This proposed action is expected to benefit the species by improving the water quality entering the phreatic system by improving the existing stormwater detention ponds and by preserving a high quality known MCI site and a surrounding forested buffer. Therefore, the proposed action is not expected to substantially change the MCI's likelihood of survival and recovery.

After reviewing the status of the MCI, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that issuance of an ITP for the construction of the Warren County Power Station is not likely to jeopardize the continued existence of the MCI. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by DVP so that they become binding conditions of any grant or permit issued to DVP, as appropriate, for the exemption in action 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service (1) fails to assume and implement the terms and conditions or (2) fails to require DVP to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the agency must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.

AMOUNT OR EXTENT OF TAKE

The Service anticipates incidental take of MCI will be difficult to detect for the following reasons: the MCI has a small body size, finding a dead or impaired specimen is unlikely, and the species occurs in habitat (e.g., caves and flooded subterranean karst areas) that makes detection difficult.

There is no methodology currently available to determine when take of individual MCI has occurred or when take limits have been exceeded. While DVP has developed a surrogate species model to predict the potential impacts of take on the MCI population, the model assumptions and uncertainties reduce its utility for quantifying or measuring take of MCI at the project site. Therefore, the amount of MCI habitat potentially affected by issuance of the permit will serve as a surrogate for incidental take of MCI. We anticipate take of MCI within 2,897 ft^2 (0.07 acres) of karst features intersected and/or affected by piles and caisson installation. This level of take includes: death or injury from impingement from falling rocks or contact with the drill bit or pile point; take in the form of harm and harassment from sediment introduced into flooded voids during drilling/driving into the phreatic zone during construction (assumed to disturb an area of 1 ft^2 around piles); and the loss of subterranean habitat due to installation of piles and caissons.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the MCI:

- Issuance of the ITP should include requirements that avoid and minimize potential effects of the project.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Service must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1) Ensure the following conditions are included in the ITP:
   a) If new sinkholes form within the project construction work area that must be filled, notify the Service's Virginia Field Office within 24 hours of formation and prior to filling, and use an inverted filter to bridge the karst feature above the water table rather than filling it below.
   b) Operators, employees, and contractors must be educated on the biology of the MCI, activities that may affect MCI, and ways to avoid and minimize these effects prior to working on site.
   c) Contaminants, including but not limited to oils, solvents, and others should be strictly controlled so the known occupied or presumed occupied habitat is not affected.

2) Ensure the following are included in the site spill plan:
   a) Construction equipment and related vehicles will not be serviced, stored, washed, or refueled within 300 feet of a streambed, sinkhole, fissure, or areas draining to these or other open throated karst features except by hand-carried cans (5 gallon maximum

capacity) when necessary.

b) Hazardous materials, chemicals, fuels, lubricating oils, and petroleum products will not be stored within 300 feet of any open throated karst feature.
c) All equipment will be checked by a DVP inspector daily for leaks prior to beginning work in karst habitat and leaking equipment will be removed or repaired the same day.
d) If a spill has impacted an open throated karst feature call the Service at 804-693-6694 to report the release in addition to the normal DVP reporting requirements.

3) Care must be taken in handling any dead specimens of proposed or listed species that are found to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead, injured, or sick MCI, notification must be made to the nearest Service Law Enforcement Office at: Division of Law Enforcement, U.S. Fish and Wildlife Service, 5721 S. Laburnum Avenue, Richmond, Virginia 23231, telephone: 804-771-2883. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Given the potential loss of MCI and its habitat in the action area, the Service recommends the following:

- Develop MCI guidelines that include a framework for analyzing project impacts, developing mitigation ideas and criteria, and best management practices.
- Continue research to improve knowledge of MCI basic biology.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions, please contact Sumalee Hoskin of this office at (804) 693-6694, ext. 128, or via email at sumalee_hoskin@fws.gov.

cc: VDGIF, Richmond, VA (Attn: Rick Reynolds)
DCR, NHP, Richmond, VA (Attn: Wil Orndorff)

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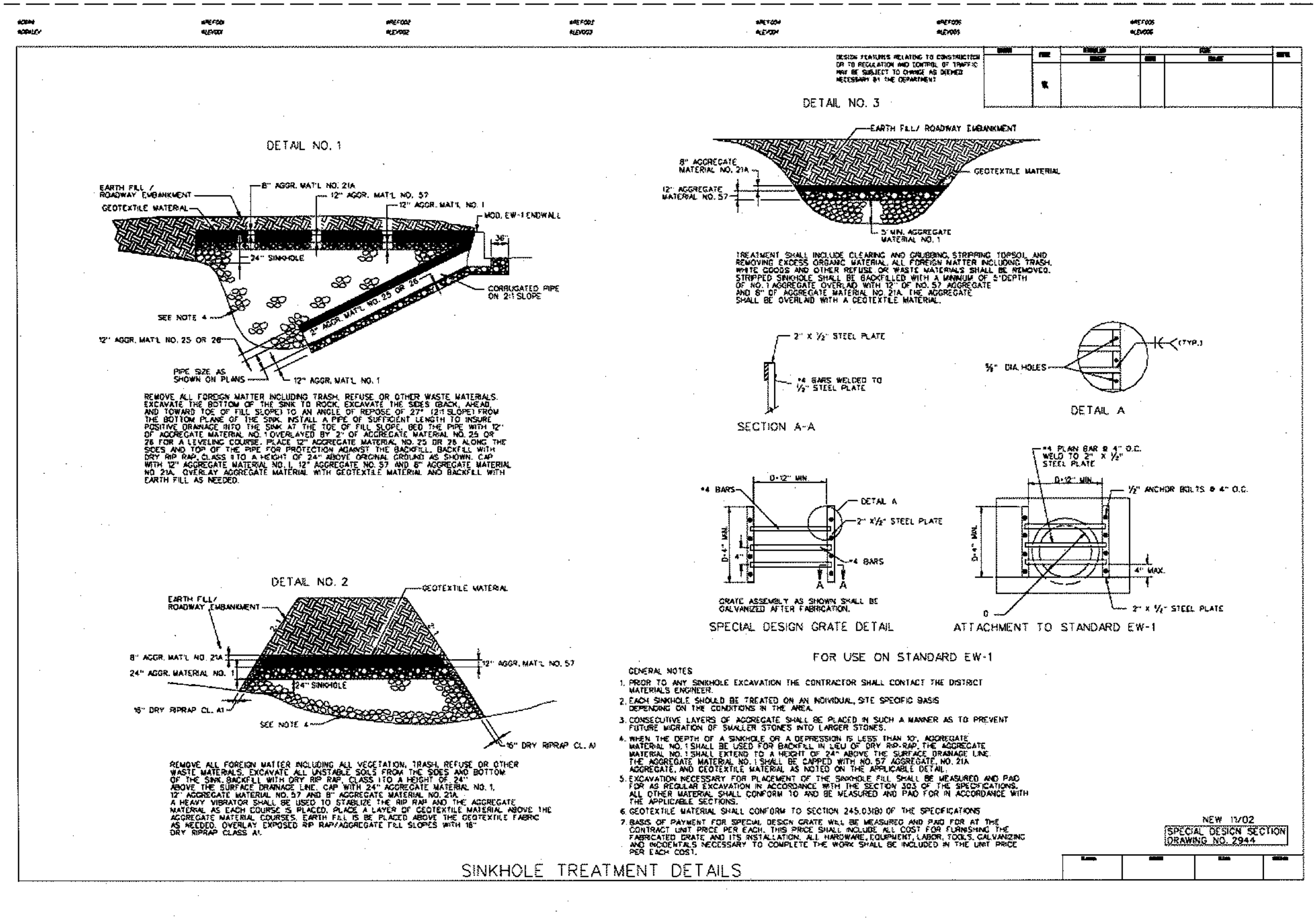

Figure 1. Schematic of inverted filter for filling sinkholes in karst areas

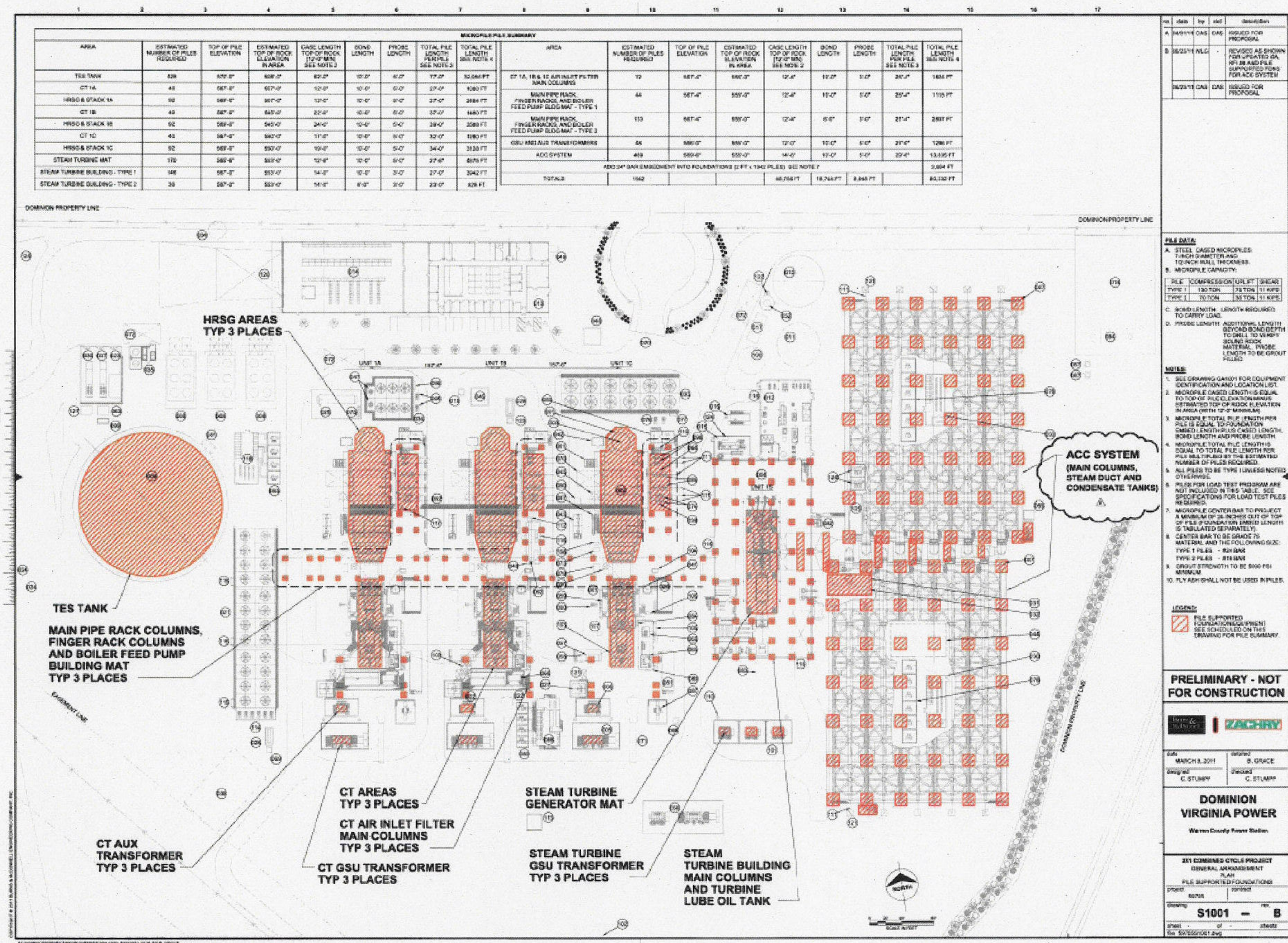

Figure 2. Schematic of pile-supported foundations

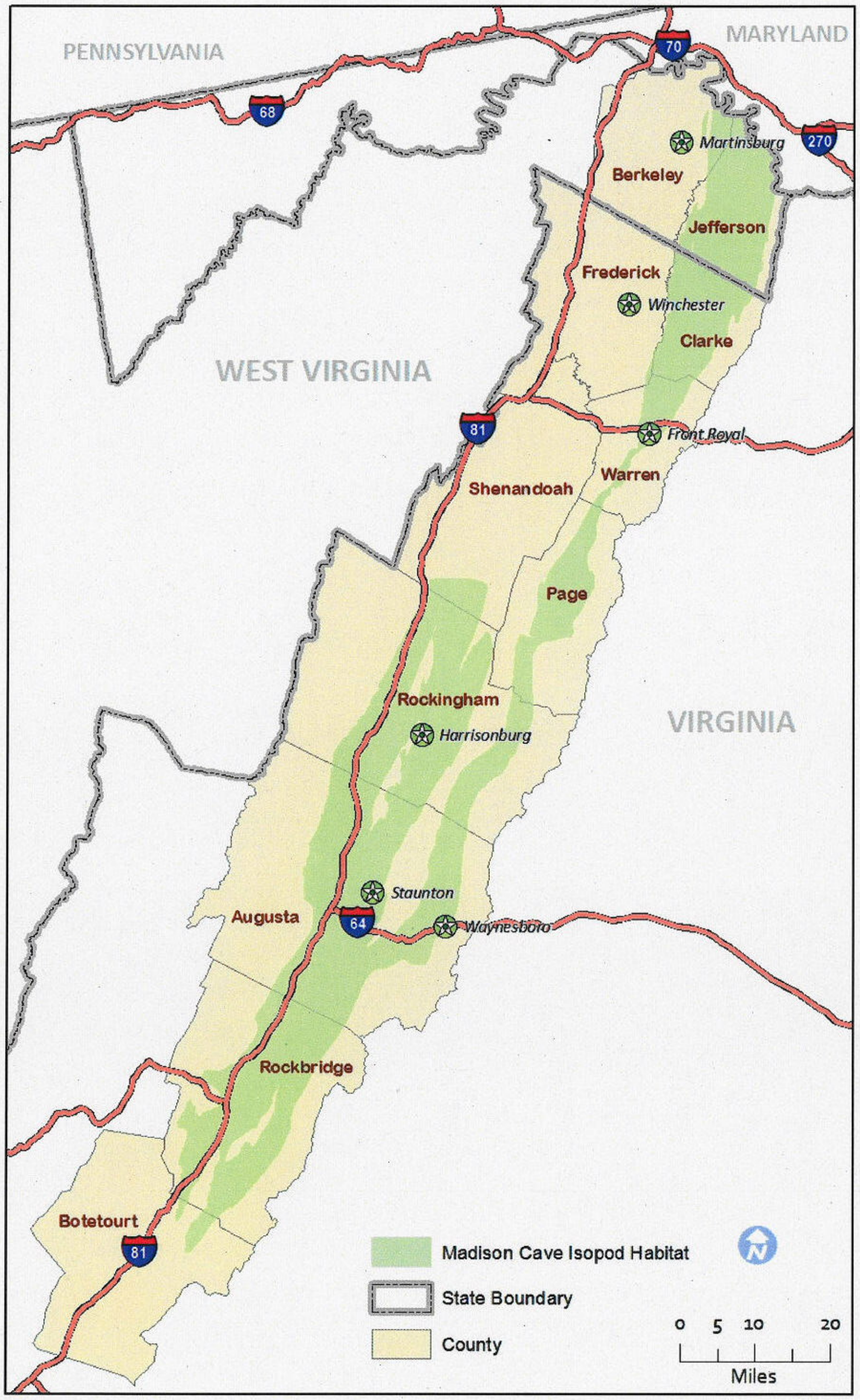

Figure 3. Distribution of Madison Cave isopod in Virginia and West Virginia.